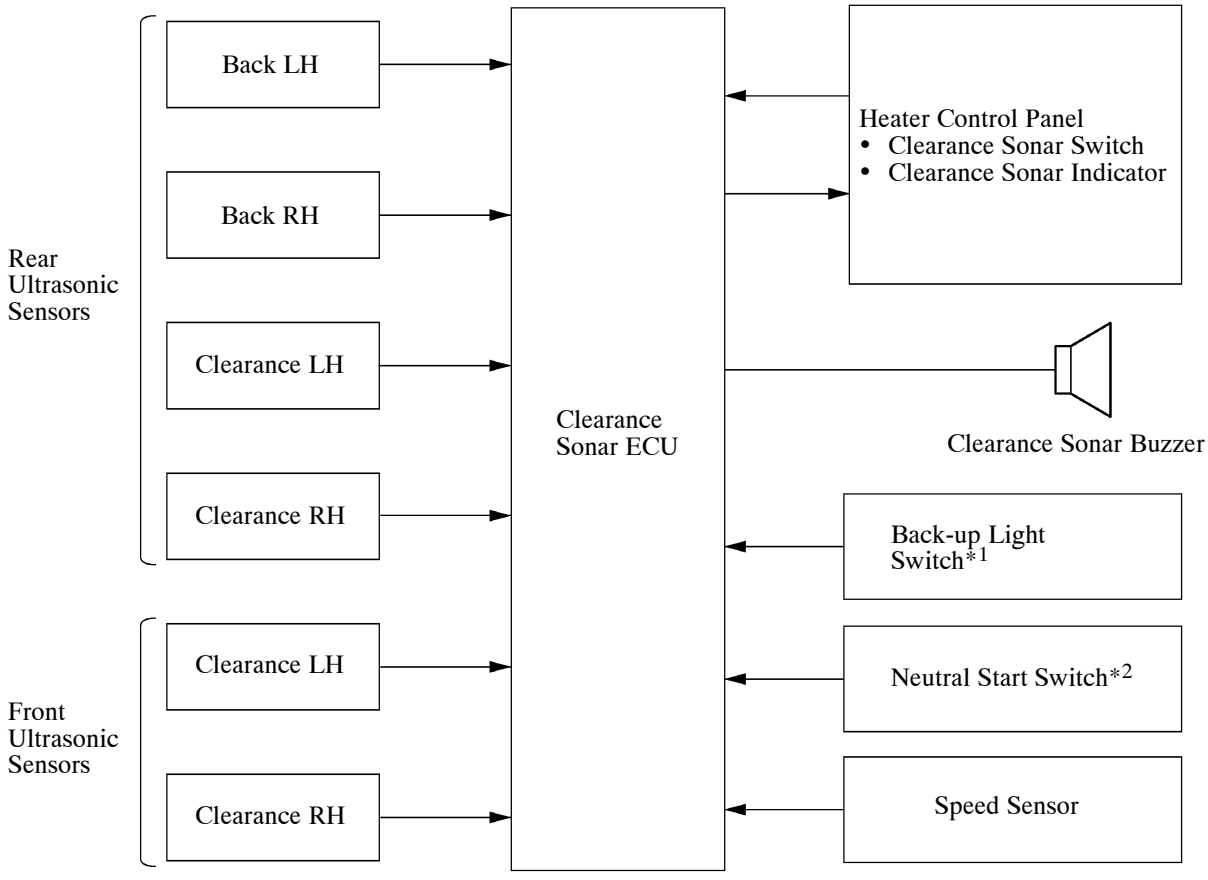
TOYOTA PARKING ASSIST SYSTEM

■FRONT AND REAR CLEARANCE SONAR

1. General

- The Toyota parking assist system is provided on the GL grade models with the 2TR-FE engine for general countries as optional equipment.
- This system uses ultrasonic sensor equipped with an indicator and beeping alarm to detect obstacles at the corners in front of the vehicle and at the rear of the vehicle, and provides information to the driver regarding the distance between the sensors and the obstacles and the position of the obstacles.
- When an obstacle is detected by the clearance sonar system, the indicator light in the hazard switch assembly blinks and the buzzer sounds to alert the driver.

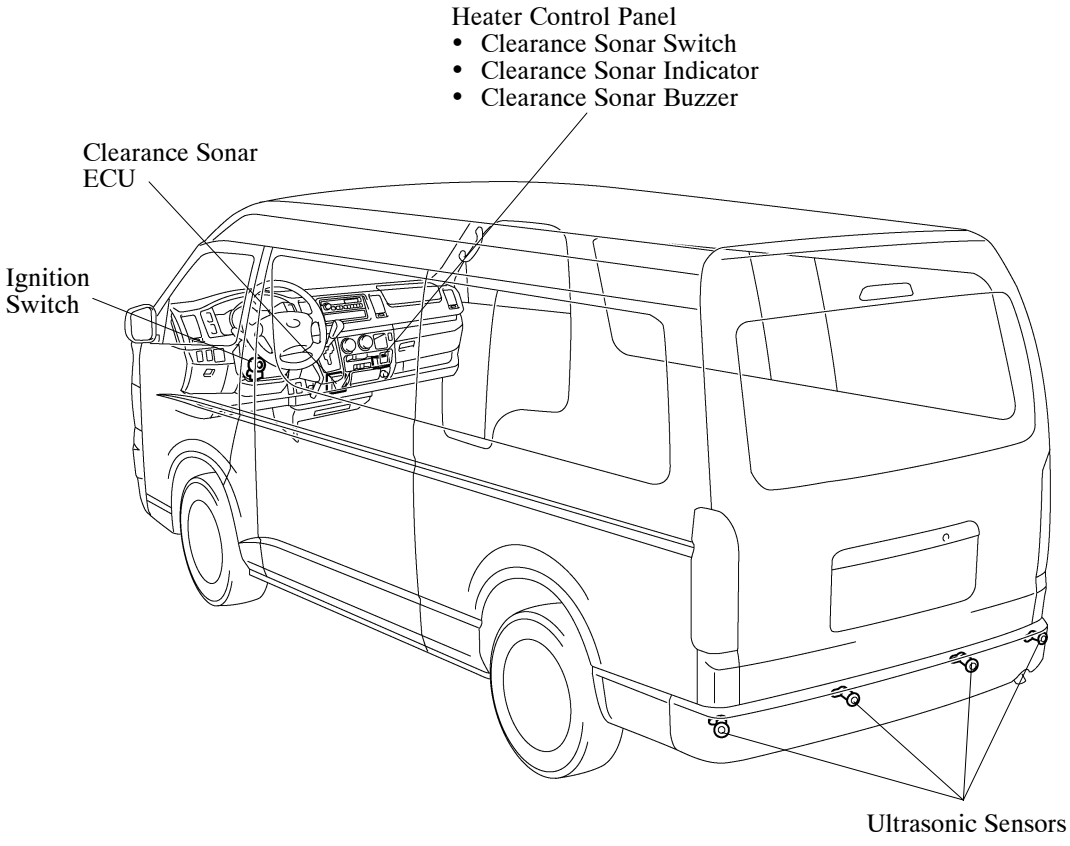
2. System Diagram

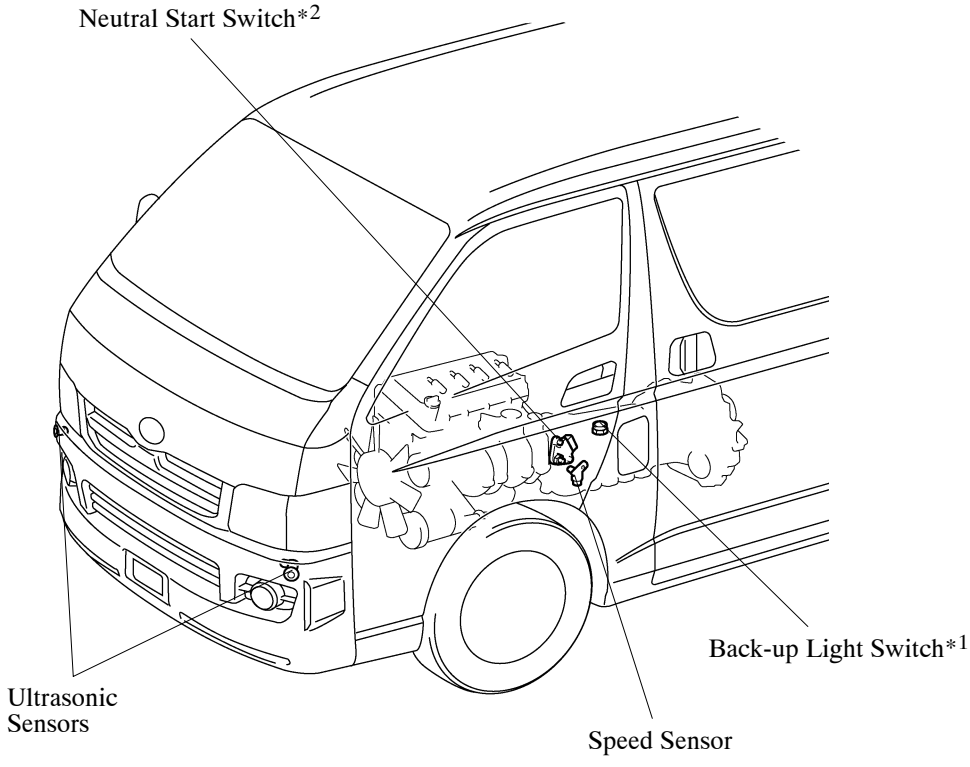


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*1: For Manual Transmission models
*2: For Automatic Transmission models

3. Layout of Main Components





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*1: For Manual Transmission models
*2: For Automatic Transmission models

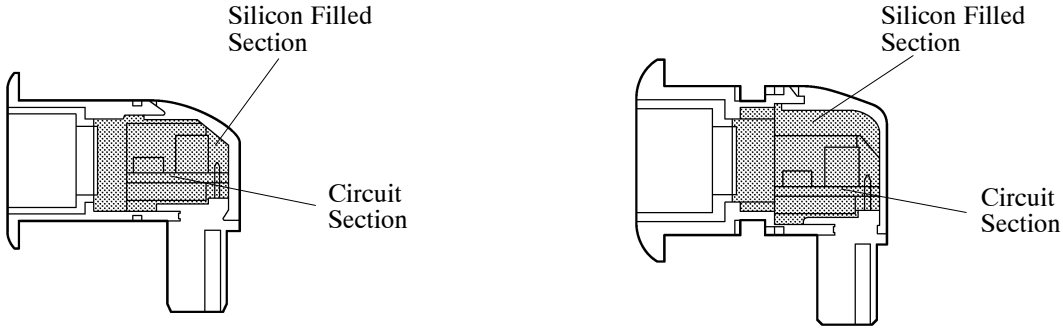
4. Function of Main Components

Component	Function
Ultrasonic Sensor	Detects the distance between the vehicle and the obstacle.
Clearance Sonar Switch	Turns the front and rear clearance sonar system on.
Clearance Sonar Buzzer	Emits an intermittent sound to inform the driver that the ECU has detected an obstacle within the prescribed range.
Clearance Sonar ECU	Judges the approximate distance between the vehicle and obstacle based on the signals from the ultrasonic sensors and sends the indicator signal to the indicator and the buzzer signal to the buzzer. Additionally, ECU has buzzer sound volume adjusting knob.
Clearance Sonar Indicator	Displays the location of the obstacle and the approximate distance between the vehicle and the obstacle.

5. Construction and Operation

Ultrasonic Sensor

The following numbers of ultrasonic sensors are provided: 2 along the front corners, 2 along the rear corners, and 2 on the back centers. Each ultrasonic sensor consists of a sensor portion that transmits and receives ultrasonic waves and a pre-amplifier that amplifies them. The ultrasonic sensor outputs the ultrasonic transmission and reception signals to the clearance sonar ECU.



Corner Sensor **Back Sensor**

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Prohibiting Conditions

- When the vehicle speed is 10 km/h (6.25 mph) or more.
- Gearshift lever position for all sensors:

Gear Position / Sensors	R	Except R
Front corner sensor	Detect	Detect
Rear corner sensor	Detect	Prohibition
Back sensor	Detect	Prohibition

- When detecting sensors are abnormal in open and freezing detection, and obstacle detection.

Clearance Sonar Buzzer

- The ON/OFF times of the clearance sonar buzzer vary in accordance with the distance to the obstacle as shown in the following table:

Item	Buzzer	Distance to Obstacle [cm (in.)]	ON Time (ms)	OFF Time (ms)
Front Corner	2.4 kHz	Approx. 50 (19.7) — 37.5 (14.8)	150	150
		Approx. 37.5 (14.8) — 25 (9.8)	75	75
		Approx. 25 (9.8) or less	Continuous	0
Rear Corner		Approx. 50 (19.7) — 37.5 (14.8)	150	150
		Approx. 37.5 (14.8) — 25 (9.8)	75	75
		Approx. 25 (9.8) or less	Continuous	0
Rear Center		Approx. 150 (59.1) — 60 (23.6)	150	650
		Approx. 60 (23.6) — 45 (17.7)	150	150
		Approx. 45 (17.7) — 35 (13.8)	75	75
		Approx. 35 (13.8) or less	Continuous	0

- The buzzer is installed in the heater control panel.

Attentive Information Conditions and Buzzer Beeping Pattern

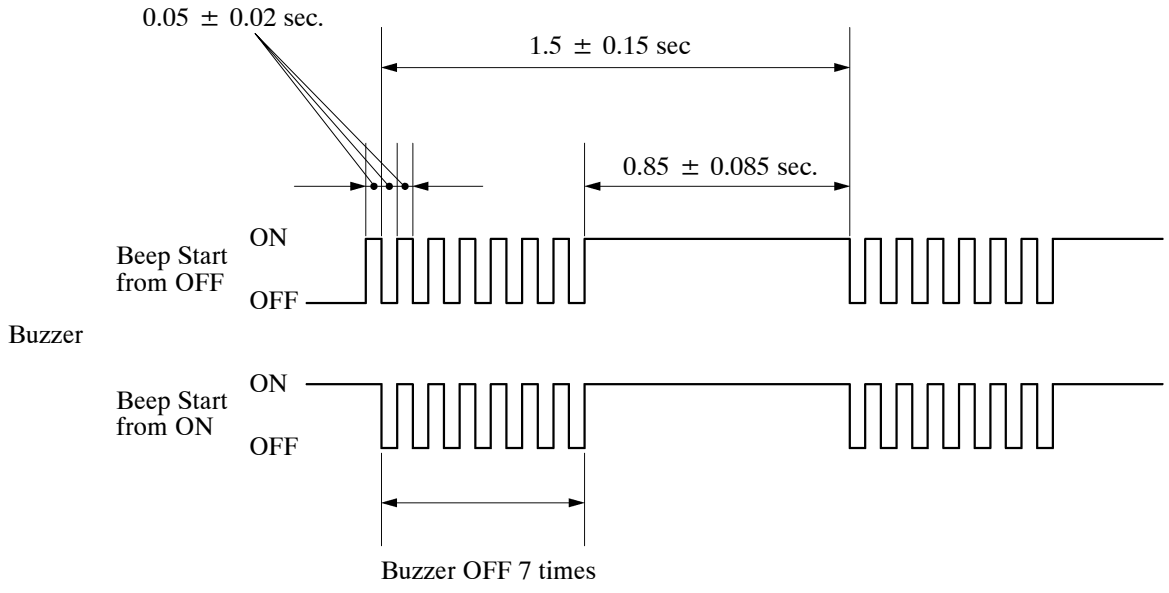
The sensors are grouped into front sensors: front corner sensors, and rear: rear corner sensors and back sensors.
The following table indicates the changes in buzzer patterns depending on obstacle detection levels.
It also shows the pattern changes in regard to detection by both front and rear groups.

Buzzer Frequency (sec.)

Front Sensor Detection Level / Rear Sensor Detection Level	1st	2nd	3rd	Non Detection
1st	Pattern B*2	Pattern A*1	Pattern A*1	Continuous Beep
2nd	Pattern A*1	0.15 sec.	0.15 sec.	0.15 sec.
3rd	Pattern A*1	0.15 sec.	0.3 sec.	0.3 sec.
4th	Pattern A*1	0.15 sec.	0.3 sec.	0.8 sec.
Non Detection	Continuous Beep	0.15 sec.	0.3 sec.	No Beep

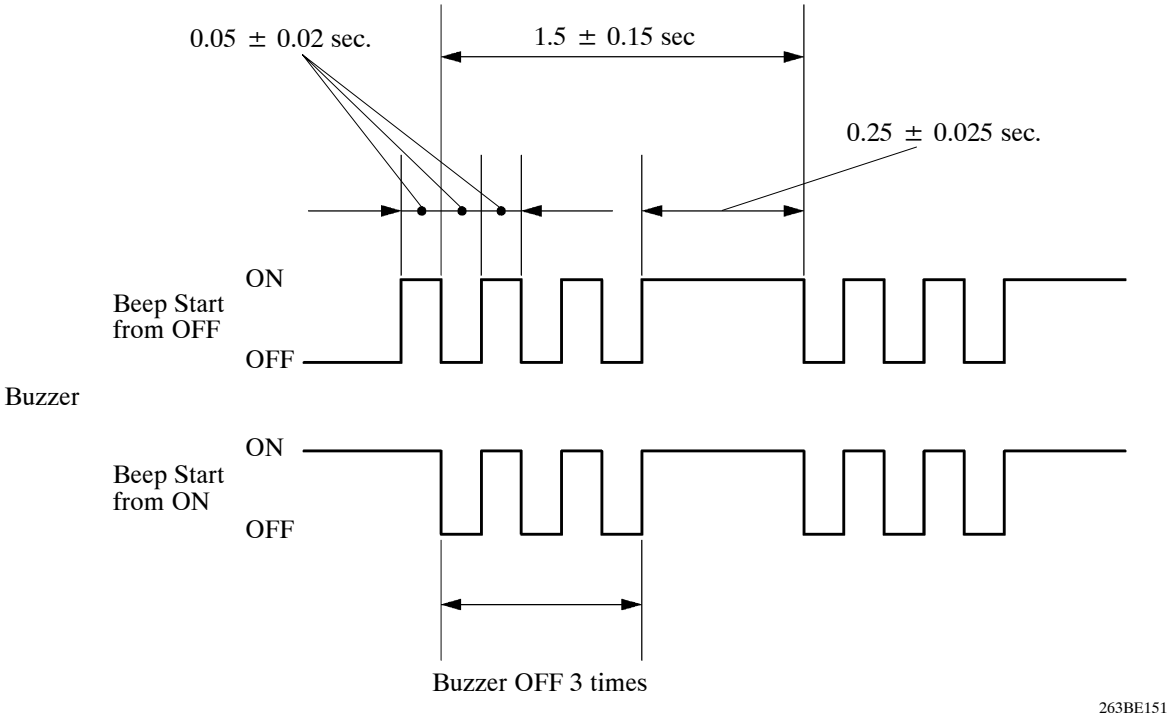
*1: Pattern A: A 1.5-second cycle, comprising 0.65 seconds of an intermittent beep (ON/OFF) period and 0.85 seconds of a continuous beep period, is repeated.
*2: Pattern B: A 0.5-second cycle, comprising 0.25 seconds of an intermittent beep (ON/OFF) period and 0.25 seconds of a continuous beep period, is repeated.

▶ Pattern A ◀



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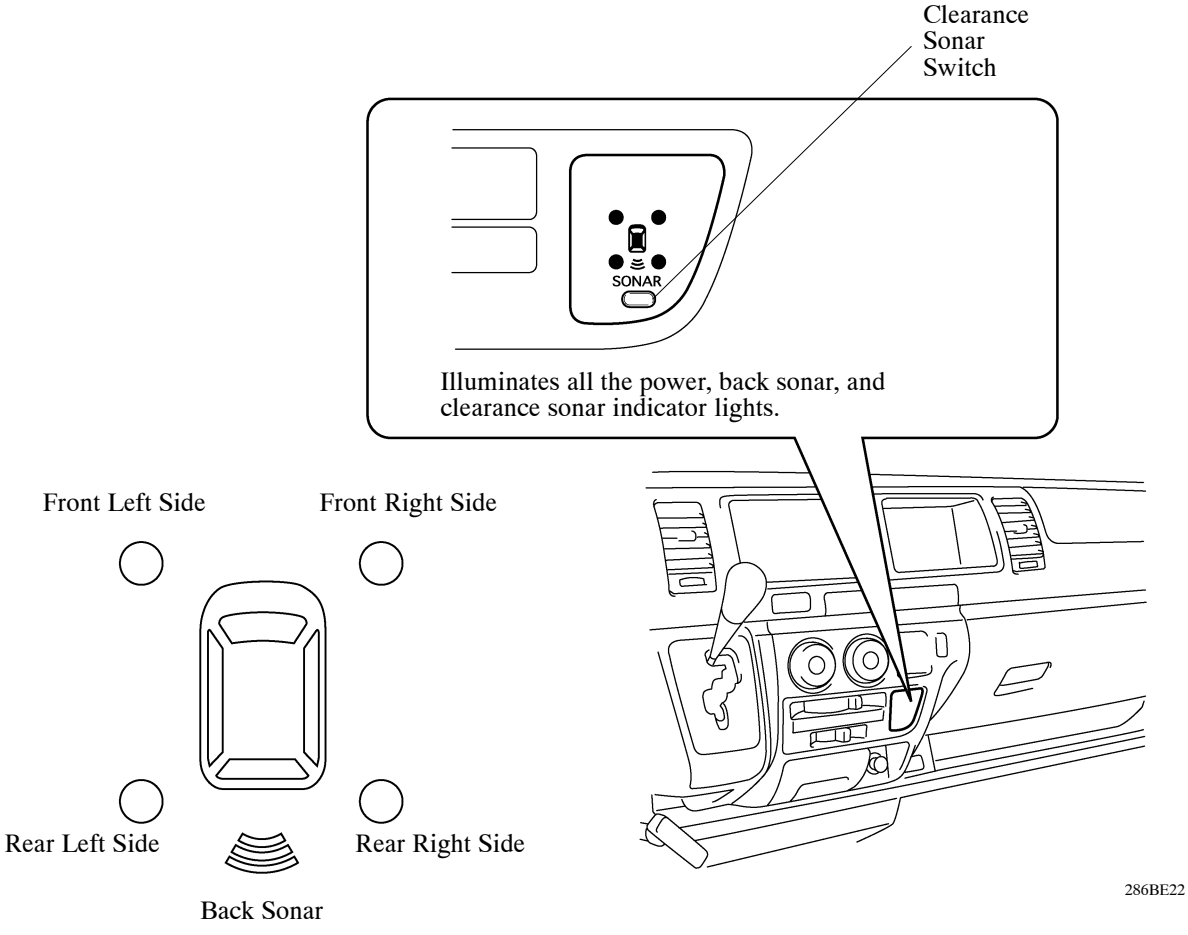
▶ Pattern B ◀



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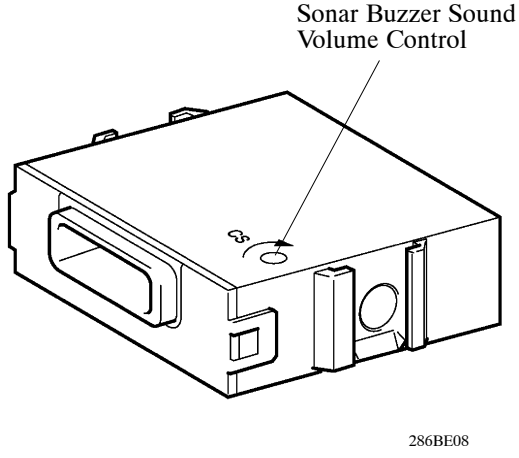
Clearance Sonar Indicator and Clearance Sonar Switch

A switch that turns the power of this system ON/OFF, an obstacle detection display, and a buzzer are provided in the heater control panel.



Clearance Sonar ECU

- The clearance sonar ECU effects overall control of the system, including the switching of the transmission, reception of the ultrasonic sensor signals, processing the received wave signals, determining the presence of obstacles, actuating the warning indicators and buzzer, and detecting an open circuit in the sensors.
- The sound volume of the clearance sonar buzzer can be adjusted at the clearance sonar ECU.



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6. System Operation

Detection Activation

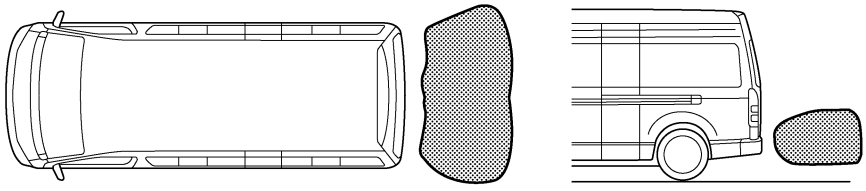
This system activates when the ignition switch is turned ON, the clearance sonar switch is turned ON, and the conditions shown below have been met.

○: Detection

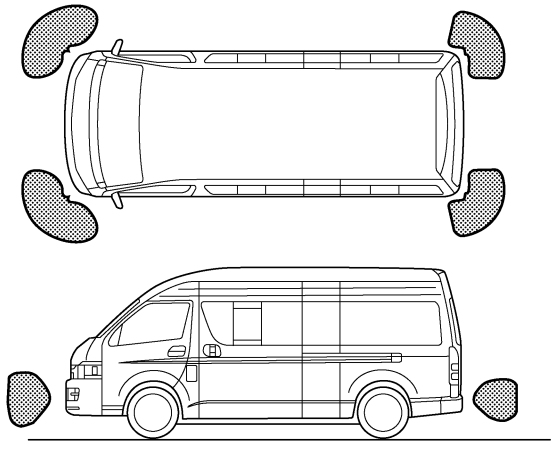
Gear Position / Sensors	P	R	Other than P and R
Front corner sensor	—	○	○
Rear corner sensor	—	○	—
Back sensor	—	○	—

Detection Range

▶ Back Sensor Range ◀



▶ Corner Sensor Range ◀



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Initial Check (Self-diagnosis)

After the TOYOTA parking assist system has been activated, it illuminates the indicator light and sounds the buzzer for about 1 second, while checking for any malfunction in the ultrasonic sensors.
If the system cannot activate its detection function due to a malfunction in an ultrasonic sensor, it alerts the driver of the malfunction by the indicator light for the malfunctioning area and the buzzer in synchronization with the flashing light. For details, refer to the Hiace Repair Manual (Pub. No. RM1171E).

7. Handling Precautions

The detection function of this system may not operate properly in the following conditions below:
- When ice, snow or mud gets on the sensors. If they are removed, the system will work properly.
- When the sensor is frozen. If defrosted, the system will work properly.
- When the sensor is covered with something. If it is removed, the system will work properly.

NOTES:

Especially in cold weather, a malfunction warning screen may appear on the display due to frozen sensors. If the malfunction warning screen appears on the display, be sure to check the sensor. If the malfunction warning screen appears despite no mud, ice or snowflakes on the sensor, the sensor might have malfunctioned.

The following conditions may have an influence on the detection range:
- When foreign matter such as snowflakes or mud gets on the sensor.
- When the vehicle is operated under a scorching sun or in a freezing climate.

The system may improperly detect in the following conditions:
- When the vehicle is being driven on bumpy road, gravel road, or on grass.
- When the sound of horns from other vehicles, the sound of a motorcycle engine, the sound of air brakes of large truck, or an object that generates ultrasonic waves is in the vicinity of the vehicle.
- When there is a downpour or water is splashing on the vehicle.
- When the vehicle posture tilts significantly.
- When an antenna for a wireless transmitter is mounted on the vehicle.
- When the sensors are covered with mud, ice, or snow.
- When the vehicle travels in the direction of a tall curb or square curb.
- When the other vehicles with sonar are in the vicinity of the vehicle.
- When towing hitch is mounted on the vehicle.

There are cases in which the objects listed below cannot be detected:
- Thin objects such as wire or rope.
- Objects with too small surfaces to reflect ultrasonic waves such as wire gauze or fence.
- Objects that absorb sound waves such as cotton or snow.
- Objects that have sharp edges.
- Objects that are short in height.
- Objects that are tall and protrude at the top.

Others:
- Objects directly underneath the bumpers cannot be detected. Even if objects that are located lower than the sensors or thin stakes are detected once, they might not be detected after the vehicle comes closer to those objects.
- An object might not be detected if it comes too close to the sensors.
- The sensors might not detect properly if they are exposed to strong shocks such as being struck or having objects thrown at them.
- Be careful not to let steam or high-pressure water of car washers or any other water get into the sensor section. When using them, keep them as far away from the sensor section as possible.